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TELEVISION EDUCATION IN ELEMENTARY SCHOOL SPEECH IMPROVEMENT.

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A PILOT STUDY WAS REPORTED ON THE USE OF A COMBINED TELEVISION-CLASSROOM GROUP PROGRAM IN REMEDIAL SPEECH INSTRUCTION. THE SAMPLE CONSISTED OF 535 PUPILS FROM THE ELEMENTARY SCHOOLS OF HAWAII WHO WERE DIVIDED INTO THREE GROUPS (1) TELEVISION-CLASSROOM INSTRUCTION, (2) NON-TELEVISION-CLASSROOM INSTRUCTION, AND (3) NORMAL THIRD-GRADE INSTRUCTION IN THE LANGUAGE ARTS. A WORKSHOP WAS HELD AT THE CONCLUSION OF THE PROGRAM FOR THE EXPERIMENTAL TEACHERS. THE SUBJECTS WERE PRE- AND POST-TESTED BY VARIOUS MEASURES. THE IMPROVEMENT SCORES OF THE TELEVISION CLASSROOM INSTRUCTION GROUP WERE SIGNIFICANTLY HIGHER THAN THE SCORES OF THE NORMAL CLASSROOM INSTRUCTION GROUP BUT WERE NOT SIGNIFICANTLY HIGHER THAN SCORES OF THE NONTELEVISION-CLASSROOM GROUP. MATERIALS THAT ARE PERTINENT TO THE SUBJECT'S PROBLEMS AND TEACHER AWARENESS OF PROPER SPEECH CORRECTION TECHNIQUES WERE FOUND TO BE MORE IMPORTANT FACTORS THAN TELEVISION PRESENTATIONS IN THIS SPEECH IMPROVEMENT PROGRAM. (RS)

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The multiple racial groups represented in Hawaii have strongly influenced the language patterns of the people of Hawaii. The resulting influences of these racial groups have brought about a commonly used substandard regional American-English dialect, containing frequently employed phonetic and rhythmic inadequacies (1). The high frequency of dialectal articulatory errors has made Hawaii a fertile area for experimentation in group articulation programs. The investigator believes that educational television has offered a challenging opportunity for supplementary group remedial speech instruction, and has used a pilot study to explore the possibilities inherent in a combined television-classroom group articulation program (2).

The pilot study, completed in May, 1959, attempted to determine if a remedial program using pertinent speech improvement materials and techniques, could be conducted simultaneously by a remedial specialist on television and by a classroom teacher in her own classroom. The pilot project utilized 87 third-grade pupils in nine experimental groups and 82 third-grade pupils in nine control groups. These children all misarticulated [θ] and [ð], and came from five Honolulu schools. The following general result was found: the mean number of errors for the experimental group was 9.8 less than the control group's mean errors. This difference of 9.8 was statistically significant ($P < .001$).

PURPOSE

Data was sought concerning the following questions which the pilot study failed to answer regarding elementary school children with dialectal articulatory defects in Hawaii.

1. Would a larger, more representative sample of pupils (than in the pilot study) taking an experimental, group television-classroom speech improvement course covering vowels as well as consonants, show significantly better articulation than a control group receiving speech improvement in the normal elementary language arts program at the end of the study?

2. What would be the relative values of an experimental group <u>television-classroom</u> instructional program versus an identical experimental group <u>non-television-classroom</u> instructional program under the following conditions: (a) both groups would utilize identical materials which were pertinent to the dialectal articulation problems of Hawaii's children, (b) both groups would employ a knowledge of proper speech correction techniques. Would the experimental group non-television-classroom speech improvement course show significantly better articulation than a control group receiving speech improvement in the normal elementary language arts program at the end of the study? Would there be any

significant difference in articulation improvement between the two experimental groups?

3. How much significant change would remain in the articulation of all experimental and control children when they were retested four months after the study was completed?

4. Would racial ancestry significantly affect the degree of improved articulation in the experimental and control groups? Particular interest would be focused on children of Japanese, Chinese, Hawaiian and part-Hawaiian, and mixed background.* The combining of Hawaiian and part-Hawaiian into one racial grouping follows established Bureau of Census racial grouping procedures in Hawaii according to Le Vine, Dole and Iwakami (3).

5. Would parental occupational backgrounds significantly affect the degree of improved articulation in the experimental and control groups?

6. What differences in personality characteristics, e.g., the degree of interest and motivation in speech improvement,

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*A child was considered to be of mixed ancestry if his racial background contained two or more of any of the above-mentioned groups (plus Caucasian). However, if one of the groups in the child's background was Hawaiian, he was placed in the Hawaiian and part-Hawaiian category. The selection of the specific racial groups was dictated by the availability of sufficient subjects to make up any one race group. This information did not become available until after the initial population selection.

would result from student participation in the two experimental programs? Would there be any significant difference in these personality characteristics between either experimental group and the control group?

7. Would the size of the individual speech groups influence the efficiency of speech improvement?

A study of the literature revealed little about teaching remedial speech on television, except for the previously mentioned pilot study conducted by the investigator (2). Two investigations of television education in related areas were reported on the college level. Nelson (4) taught a basic speech course, and Cobin (5) employed television in teaching interpretation. The paucity of published research indicated a need for further exploratory studies.

PRELIMINARY PLANNING

The Department of Public Instruction furnished the investigator with a list of 18 rural and urban Oahu elementary schools whose principals and third-grade staffs were interested in the experiment.* This particular grade level was chosen because it had been used in the pilot study and would provide continuity between the pilot project and the follow-up experiment.

Prior to organizing the major sequential phases of the experiment, it was necessary to plan a time table. The 1960-1961 year was planned roughly in the following manner.

April, 1960 - August, 1960	preparation of the workbook
September, 1960 - October, 1960	pre-articulation testing
November, 1960 - December, 1960	eight-hour teacher's workshop
January, 1961 - April, 1961	experimental teaching
May, 1961 - June, 1961	post-articulation testing
September, 1961	follow-up articulation testing

Five sounds were selected for presentation to the children. This list of sounds was an attempt to teach those vowels and consonants that appeared to be most frequently misarticulated in the community.

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*Two schools decided not to participate in the experiment, and the study was carried out with 16 schools.

The following criteria were used: (a) the investigator's teaching experiences in Hawaii, (b) the investigator's findings in the pilot study, (c) the investigator's clinical observations of the miserticulations of young children and adults in the community. The five sounds selected were: [θ, ð, ɹ, ɛ, ʊ] . In addition to the previously discussed reasons, the repeated use of the two consonants taught during the pilot study would provide additional continuity between the pilot and the follow-up project.

METHOD

Testing Procedures. The investigator prepared a special battery of picture-reading articulation tests which would meet the special requirements of the study. The test was prepared by adapting the Bryngelson-Glaspey Speech Improvement Cards into a battery of five picture-reading tests: (a) a combined [θ] - [ð] test, (b) individual tests for [ɪ], [ɛ] and [ʊ] (6). The non-reading portion of the test was composed of 26 pictures of noun objects commonly known to most eight and nine-year-old children living in Hawaii. The reading portion of the test was composed of 34 vocabulary items which were placed in a series of simple sentences. All test and non-test lexical items were selected from a basic reading vocabulary list prepared by Gray, et al. (7). Most items were taken from the preprimer and primer levels, and no word was used beyond the 2/2 reading comprehension level. Each test required a total of 12 different responses, divided between pictures and vocabulary items. Each vowel test contained six pictures and six lexical items. The [ð] test contained one picture and eleven lexical items, while the [θ] test had seven pictures and five lexical items. The differences in the distribution of reading and non-reading test items in the [θ] - [ð] tests were mainly due to the lack of suitable common pictures for [ð] combined with a scarcity of [θ] lexical items below the third-grade reading level. The pictures and sentences were arranged in the following fashion. The pictures

were pasted on cards. The sentences with the key words were typed on pieces of paper which were folded and pasted underneath certain pictures, e.g., a picture of a book with a sentence below reading "Don't push the poor baby," illustrated three items on the [u] test.

To secure judging reliability, the test battery was administered in May, 1960 to a pilot group of 29 third-grade children who misarticulated one or more of the five key sounds. Each child's responses were tape recorded, and six members of the Department of Speech at the University of Hawaii independently judged the tapes. These instructors were all currently engaged in teaching speech improvement to college freshmen whose articulation problems closely duplicated the sound errors of the third-grade children. Coefficients of correlation were obtained between all instructors. The selection of judges was limited to the four instructors who demonstrated the highest inter-correlations for the five sounds. The highest correlations were: .80, .82, .83, .87, .88, .91. It was planned to have each judge rate the same group of children on each of the scheduled tests: the pre-articulation test, the post-articulation test, and the follow-up articulation test. The use of single judges rather than panels was dictated by the large population and the excessive amount of time required in evaluating each test battery. It was believed the single judge method was reliable because of the high inter-correlation between judges, and the expectancy that each judge would agree with

his own previous judgments.* Further support of judging reliability came from a later series of high inter-correlations between the same judges (see p. 10). The judges were never told that they would be listening to the same group of children during each set of tests, nor were they ever told if they were rating experimental groups, control groups, or children from both groups during their rating sessions.

During August, 1960 the investigator mailed to the principals of the 16 elementary schools an explanation of the testing procedures to be carried out during September and October. Each school was assigned a date for articulation testing. The principals discussed the testing procedures with their third-grade staff, and each teacher prepared a list of children to be tested. Each child had to meet three requirements to qualify for testing: (a) the child must be misarticulating at least one of the five previously mentioned sounds, (b) the child must have been born in Hawaii and lived there all of his life, (c) the child must have had no physical problems that could influence his speech, e.g., cleft palate, hearing loss, etc. Two graduate students in speech correction from the University of Hawaii and the investigator went into the field and tape recorded 607 children using the articulation battery discussed earlier. The battery was administered in an orthodox manner of

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*This expectancy was later corroborated by correlating the pre-test and post-test ratings made by each judge on his control subjects. A significant correlations of .79 ($P < .01$) was obtained between these two successive sets of ratings.

articulation testing. When the child was unable to recognize a picture or read part of a sentence, the tester identified the picture or said the word for the pupil. Recent research supports this technique of verbalizing test items for speech defectives (8, 9).

Each of the four judges was arbitrarily assigned a group of schools, and they each evaluated approximately 150 children. A further reliability check was made by having all of the judges rate a common pool of 21 children, and then establish inter-correlations between the judges. The following high inter-correlations were found: .81, .84, .87, .90, .92, .93.

Group Selection. Any child who was judged to have made one or more errors on any sound was selected to participate in the experiment. Forty-five children were eliminated from the study because they didn't misarticulate any of the test sounds, or because technical difficulties in recording made accurate evaluations impossible. This left a total of 562 children in 56 class groups. Twenty-seven children in groups containing less than five participants were automatically eliminated, since the investigator felt that groups of less than five would rarely occur under normal teaching conditions. This left 535 children in 46 class groups. There were no significant differences between overall means on the pre-test, nor were there significant differences between males or females from one group to another in the pre-test scores. However, males were significantly worse than females by 1.14 greater errors over all sounds and all conditions ($P < .01$, see Table IV).

The remaining 535 children were divided into three major categories by using a random number system: (a) Condition I, which would be involved in the television-classroom instructional program, (b) Condition II, which would be involved in the non-television-classroom instructional program, (c) Condition III, which would follow the normal third-grade language arts program in the various schools. It was planned to distribute the groups in a random order in a 15, 15, 16 ratio, but the unexpected decision of two experimental teachers to remain in the study only on a control basis resulted in the following allocation of groups. Condition I contained 169 children in 14 classes, with group distributions ranging in size from 6 to 20. Condition II contained 171 children in 14 classes, with group distributions ranging in size from 5 to 18. Condition III contained 195 children in 18 classes, with group distributions ranging in size from 5 to 25.* Seven participating schools contained members of the experimental and control population, five schools contained only members of the experimental population, and four schools contained only members of the control population. Pupils from experimental and control speech groups were never mixed in the same third-grade classes in the seven schools containing both experimental and control groupings.

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*The average total number of children in each third-grade classroom was 32. This figure of 32 was not important, because the balance of the class in excess of the speech defective group was not involved in the experiment.

Workshop. Comments made by teachers of experimental groups at the conclusion of the pilot study indicated the desirability in any similar future project of a brief workshop in speech improvement pedagogy which would precede the experimental teaching phase of the new study. In November and December, all 28 experimental teachers attended an eight-hour workshop which dealt with these areas: (a) a review of the speech mechanism, (b) a review of articulatory phonetics with special emphasis on the five sounds to be taught to the experimental classes, (c) a review of methods and techniques of speech improvement pedagogy, (d) familiarization with the procedures used in running the experiment.

Organization of the Experimental Course - Condition I. The purpose of Condition I was to further test the effectiveness of supplementing classroom instruction and demonstration with direct television instruction and demonstration, using materials that dealt with Hawaii's specific articulation problems. The experimental teaching phase of the experiment lasted for 16 weeks, including one week for Easter vacation. During each school week, the children in Condition I received one fifteen-minute lesson every day for a total of 75 speech improvement classes during the entire experimental period. Each week the investigator televised two, fifteen-minute lessons from the television studio. Each group of pupils viewed the instructional telecasts in their own classroom on rented, 23-inch R.C.A. receivers which had been placed in their

room for the experimental period. The remaining three, weekly fifteen-minute classes were taught by the classroom teacher in her own classroom. Each of the five sounds was studied formally for three weeks, and was then reviewed systematically for varying amounts of time in the remaining weeks, according to the following schedule. Notice that the only sound that was not reviewed was [ʊ] which was presented last. Actually the last four sounds were not given a full three weeks of formal study, since part of the systematic review of the previously covered sounds occurred during the regularly scheduled fifteen-minute speech periods.

SOUND	FORMAL STUDY	AVAILABLE REVIEW TIME
1. [θ]	3 weeks	13 weeks
2. [ð]	3 weeks	10 weeks
3. [ɪ]	3 weeks	7 weeks
4. [ɛ]	3 weeks	3 weeks
5. [ʊ]	3 weeks	0 weeks

The five sounds chosen were ranked on the list according to their probable frequency of misarticulation, with the most frequently misarticulated sounds appearing first. It was not possible to study the results of the pre-articulation test to determine the exact frequency of misarticulation, because the workbook was already completed (see below).

It was necessary to prepare and select teaching materials for the experimental classes. Three textbooks were chosen for their strength in either drill materials or in speech improvement pedagogy (10, 11, 12). Since none of these books thoroughly covered all of the specific articulation problems being presented to the children, the investigator prepared a 97-page mimeographed workbook which served as a master syllabus for the entire experimental course. This booklet contained: (a) an outline of all the daily lesson plans, (b) supplemental information on sound formation and the speech mechanism, (c) additional suggestions for teaching speech improvement, (d) further drills for each of the five sounds being taught.

Organization of the Experimental Course - Condition II. The purpose of Condition II was to measure the effectiveness of the materials and techniques employed in Condition I when these factors were incorporated without the bi-weekly television classes. These children followed the same schedule of five, fifteen-minute speech lessons each week, except that their own classroom teachers taught all 75 experimental classes. In every other respect, the program followed by Condition II was identical to the program followed by Condition I children.

Organization of Condition III (Control). The purpose of this group was to measure the effectiveness of the current Hawaii elementary language arts program. The programs in the control classes were determined by the individual teachers in conjunction with the established language arts

guide published by the Department of Public Instruction (13). The teachers were not told which of their children were included in the experiment until the experimental teaching period was completed. At that time a questionnaire was sent to each of the 18 Condition III teachers requesting the type and amount of speech improvement that she had carried out during the school year. She was asked if she had taught any of the experimental sounds during the following periods: (a) between the start of school and the start of the experimental teaching period (9/1/60 - 1/9/61), (b) during the experimental teaching period (1/9/61 - 4/28/61), (c) during both periods. The teacher was also asked if she had taught speech improvement incidentally or systematically. Incidental teaching was defined as speech improvement that was incidental to the lesson - speech improvement was not presented during regularly scheduled periods with pre-planned lessons, materials, homework, etc. Systematic teaching was defined as speech improvement that was taught during regularly scheduled periods with pre-planned lessons, materials, homework, etc. The responses to the questionnaires are listed below.

Sound	Taught 9/1/60-1/9/61	Taught 1/9/61-4/28/61	Taught Both Periods	Total	Did Not Teach the Sound
	1	2	10	13	5
	0	4	12	16	2
	0	4	13	17	1
	0	3	12	15	3
	0	3	6	9	9

Total Who Taught Systematically - 6
Total Who Taught Incidentally - 12

Several other forms and questionnaires were also sent to teachers of the various groups to secure additional background data on each child. The requested information is listed below.

1. The parents of all experimental and control children received a questionnaire requesting the following information: (a) parents' racial ancestry, (b) child's racial ancestry, (c) parents' job status*, (d) parents' education.

2. Each experimental and control teacher was requested to furnish the investigator with every child's scores on the California Test of Mental Maturity, Short Form. This test was normally administered to third-grade children during the early spring of the year.

3. All experimental and control teachers were requested to fill out a personality rating test for each child. It was hoped this test would provide some indication of the children's reactions to the speech improvement lessons. This test, which is available by personal correspondence, was derived by S. Sarason and K. Davidson to measure contrasting personality characteristics.

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*It was planned to follow the Classified Index of Occupations and Industries prepared by the Bureau of Census (14). This index contains the following major divisions: (a) Professional, Technical and Kindred Workers, (b) Farmers and Farm Managers, (c) Managers, Officials, and Proprietors, Except Farm, (d) Clerical and Kindred Workers, (e) Sales Workers, (f) Craftsmen, Foremen, and Kindred Workers, (g) Operatives and Kindred Workers, (h) Private Household Workers, (i) Service Workers, Except Private Household, (j) Farm Laborers and Foremen, (k) Laborers, Except Farm and Mine (Mine Included in Operatives and Kindred Workers).

The investigator utilized the following paired terms from the original test: (a) anxious - unanxious, (b) sensitive - non-sensitive, (c) ambitious - unambitious, (d) fears failure - does not fear failure, (e) pays attention - does not pay attention. The instructions were modified so that they dealt with the child's reactions in any speech improvement situations throughout the entire school day.

Experimental Classroom Procedures - Condition I. The children in each experimental group sat together in one section of their regular classroom while receiving non-televised speech instruction. The remaining class members stayed in the room during this time and were assigned various non-verbal activities. During the televised speech lessons, the special students sat in a semi-circle around the television receiver. The balance of the class observed the televised lessons from their regular seats, but did not participate in the lessons. Teachers of small groups, e.g., those with seven or less in the class, were generally able to permit the pupils to respond individually during drill work, but teachers of larger groups were forced to use choral responses. Many of the teachers of the larger groups were also forced to sub-divide their group into one or more sub-sections, depending upon the size of the total group, e.g., a class of 16 children was sub-divided into two sections of eight each, and the teacher listened to the choral responses of one section at a time.

Implementing the Daily Lesson Plans - Condition I. The teachers prepared their daily speech activities in accordance with the pre-planned units which were spelled out in the workbook. These lesson plans were based on the following types of materials found in the workbook.

1. Drill suggestions from the materials found in the three textbooks.

2. Drill suggestions from special materials reproduced in the workbook with the permission of various publishers.

3. Special word, phrase, and sentence drills which were written by the investigator. These drills were constructed around vocabulary items taken from the New Basic Readers (7). A few of the lexical items came from the 3/1 and 3/2 reading comprehension levels, but most of the words were from the 2/2 level and lower.

The teachers were cautioned to follow the sequence of lesson plans carefully in order to adhere to the pre-planned remedial training sequence, e.g., they could not introduce role playing when the syllabus called for ear training. However, in preparing a specific lesson plan, the teachers were free to select any desired drill from among the suggested exercises for that day. The only exceptions to this were the lesson plans for the television classes. This lesson plan categorically stated the specific drills the principal

investigator planned to include in that day's work, and all teachers worked from the same plan that day. Each sound was taught for three weeks, and systematically reviewed for varying amounts of time (see p. 13). The following list of speech improvement activities was used to guide the child through the retraining steps for each sound unit.

1. Listening exercises to learn how to recognize the correct sound, to learn how to recognize the error sound or sounds, and to learn how to discriminate between the correct sound and the error sound or sounds.

2. Simple explanations and demonstrations for forming the sounds.

3. Verbal drills starting with the isolated sound and working through syllables, words, phrases, sentences, simple poems and jingles.

4. Free speech drills including role playing, and simple games designed to elicit spontaneous speech.

5. Frequent attempts to integrate the new speech pattern into other work units and classroom activities.

6. Planned attempts for carry-over of the new sounds into the home.

Special Televised Procedures. The physical properties for the television set consisted of a desk, several chairs and an easel. The investigator taught the class from his seat at the desk. All drills were

prepared on sheets of 15 by 20 inch Crescent T-V Illustration Board, #350, light grey. A printing set, utilizing 1-1/4 inch primer type, was employed to print the exercises on the T-V board, and the investigator used a pointer to reach the easel. Visual aids were employed where applicable, e.g., feathers or strips of facial tissue held before the mouth effectively demonstrated the difference between the steady expiration of breath for [θ] and the explosive exhalation of breath for [t] . Correct lip and tongue positions were clearly displayed through extreme close-up shots of the investigator's mouth. The first few programs of each sound unit were presented by the investigator alone. During these programs, he conducted listening drills and discussed how the sounds were formed. The later programs incorporated from one to three experimental children who received their lessons in the television studio. This procedure was highly successful during the pilot study. The children enjoyed and were stimulated by watching their peers handling the same drills on television that they were doing in their classrooms. These periods took the following general form when one child was in the studio. The investigator read an exercise from the easel such as "reading their book," for [ð] , and asked the child to repeat the phrase. The viewers were instructed to listen carefully and "see if the 'motor sound' was said the right way." The investigator commented on the child's articulation and asked him to repeat the phrase if he

misarticulated [ð]. Viewing pupils were then given about 15 seconds to practice the same item under the guidance of their individual teachers. When more than one child was present in the studio, they were encouraged to evaluate each other's responses as well as their own. Viewers were urged to check the television student's articulation, their own articulation, and the articulation of their peers in the speech group. Toward the middle of the experimental series, the investigator introduced a 15-inch puppet into the televised classes. This puppet alternated between being "student" and "teacher", and his presence gave added impetus to the televised classes. The main problems confronting the telecasts were production ones. The studio's handling of the speech improvement telecasts presented certain intermittent technical difficulties which were largely due to the lack of studio rehearsal time and the absence of a floor director. These problems were solved reasonably well, but the availability of an adequately staffed educational channel in Hawaii would undoubtedly have improved the quality of the television lessons.

Experimental Classroom Procedures - Condition II. The experimental classroom procedures in Condition II were identical to those in Condition I, except for the special activities surrounding the telecasts.

Implementing the Daily Lesson Plans - Condition II. The implementation procedures in Condition II were identical to those in

Condition I. This included having Condition II instructors teach from the identical lesson plan being followed by the investigator and all Condition I teachers during the televised speech periods. It was felt that this device would help to further equalize the two experimental groups.

Post Articulation Test. Immediately following the experimental teaching period, all experimental and control children were tape recorded in a random order, using the same articulation test battery presented to them previously. A total of 13 children had either transferred to other schools before the end of the study, or had moved out of the state. The total number retested came to 522. Each judge evaluated the same group of children he had rated in September. The judges were not told that they were listening to the same children, and they did not know which children were experimental and which ones were control. As an added precaution, each judge was asked if he "found any of the voices familiar." The answer was negative in each instance.

Follow-up Articulation Test. The follow-up-test was administered four months after the post-test, and was given in September, following the resumption of school after the summer vacation. All remaining experimental and control children were followed-up and tape recorded in a random order, using the same articulation test battery presented to them previously. A total of five children had

either moved out of the state or had moved to other islands, and the total number retested came to 517. Each judge evaluated the same group of children he had rated on the two previous articulation tests. The judges were not told they were listening to the same children, and they did not know which children were experimental and which ones were control. Once again each judge was asked if he "found any of the voices familiar." The answer was negative in each case.

PRE-POST-TEST MAIN VARIABLE RESULTS

The 522 children who received the post-articulation test were screened for missing data. If a child's records showed that any of the following information was deleted, the subject was eliminated from the study: (a) subject's I.Q. scores, (b) subject's and parents' racial ancestry, (c) parents' educational background, (d) parents' occupational status. The three pupils who had received some of their lessons in the television studio were also eliminated, since their training differed from the training of the other experimental children. The next step was to equalize sex differences among the three main groups. The smallest breakdown was 58 females in Condition II. Male and female students in excess of this number were eliminated at random in all other groups. This left three groups of 58 females (Condition I, II, III), and three groups of males (Condition I, II, III), totaling 348 subjects. These pupils were used in obtaining the main variable results of the experiment.

Covariance Analysis. The data was analyzed with the technique of covariance analysis (see Table I). In this analysis there were five main variables: (a) conditions (Condition I - T-V; Condition II - Non-T-V; Condition III - Control), (b) sounds [θ, ð, ɪ, ɛ, ʊ], (c) time of testing (pre-articulation test, post-articulation test, follow-up articulation test), (d) sex, (e) differences between subjects. Covariance adjustments were made according to five co-variates:

(a) language I.Q.,* (b) non-language I.Q.,* (c) father education, (d) mother education, (e) pre-articulation test score. Although correlations between covariates and the main variables were low, .32 and below, the appropriate adjustments were made. The residual mean square of 43.53 in Table I was used as the error term for testing the significance of the mean squares of the main variables and their interactions.

The variances due to all of the five main variables were significant with respect to the post-test scores, except differences between subjects ($P < .001$, see Table I). With respect to the various interactions, post-test variances were significant ($P < .001$), except for those interactions containing differences between subjects. Since improvement or a change in the error score from the pre-to-post-test main variable is of particular interest in this investigation, we shall examine the pre-post-test main variable and the manner in which it interacts with all of the other variables. Note that the analysis of covariance in Table I does not show the direction of change within a variable. The directional changes are found in Tables II, III, V, VI.

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*The language I.Q. scores and non-language I.Q. scores came from the California Short Form, Test of Mental Maturity (see p. 16).

PRE-POST-TEST MAIN VARIABLE DIFFERENCES

As seen in the analysis of covariance the pre-post-test main variable effect was a significant one. The change was an overall average of 1.42 fewer errors in the post-test than in the pre-test ($P < .001$), and was an average over all conditions and other variables (see Table III).

Pre-Post-Test X Condition Interaction. The analysis of covariance in Table I indicates that this interaction was significant. The directions of differences in Table II are as follows: (a) the average pre-post-test improvement score of 1.36 fewer errors was significantly greater for Condition I than for Condition III ($P < .01$ according to a "t" test),* (b) the average pre-post-test improvement score of .94 fewer errors was significantly greater for Condition II than for Condition III ($P < .02$), (c) although the pre-post-test improvement score for Condition I was greater than the pre-post-test improvement score for Condition II by an average of .42 fewer errors, this difference was not significant.

Pre-Post-Test X Sound Interaction. Table I indicates that this interaction was significant. The ranking per sound over all conditions and all subjects was from greatest to least with the first three sounds

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*All other differences between means were done by simple "t" tests.

showing significant pre-post-test increased differences: [θ] ($P < .01$), [ð] ($P < .01$), [ɪ] ($P < .05$), [ɛ], [ʊ] (see Table III). It might be of interest to point out here that sounds differed significantly with respect to their original difficulty on the pre-test (see Table IV). Significantly more errors were made on [θ] than the average number of errors made on all sounds ($P < .01$), significantly fewer errors were made on [ʊ] than the average number of errors made on all sounds ($P < .01$). In addition, note that on the pre-test, the males were significantly worse than the females by 1.14 greater errors over all sounds and all conditions ($P < .01$). There were no significant differences between conditions. Despite the differences in original difficulty between sounds and sexes, the analysis of covariance adjusted for these differences.

Pre-Post-Test X Sex Interaction. Table I indicates that subject improvement from pre-to-post-test differed significantly from male to female. Table III shows that males demonstrated greater difference scores than did females. The male post-test score showed an average of 1.62 fewer errors over the male pre-test scores ($P < .01$), and the female post-test score showed an average of 1.22 fewer errors over the female pre-test scores ($P < .05$).

TRIPLE INTERACTIONS INCLUDING PRE-POST-TEST MAIN VARIABLE DIFFERENCES

Condition X Sound X Pre-Post-Test. Table I indicates that this interaction was significant. The directions of differences in Table II are as follows: (a) the ranking per sound for all subjects in the comparison of Condition I over Condition III was from greatest to least, with the first three sounds showing significant pre-post-test increased differences: [θ] ($P < .01$), [ð] ($P < .02$), [ɪ] ($P < .05$), [ɛ], [ʊ]; (b) the ranking per sound for all subjects in the comparison of Condition II over Condition III was from greatest to least, with the first two sounds showing significant pre-post-test increased differences: [θ] ($P < .01$), [ð] ($P < .05$), [ʊ], [ɪ], [ɛ].

Condition X Sex X Pre-Post-Test. Table I indicates that this interaction was significant. The directions of differences in Table II are as follows: (a) the males improved significantly more than the females did in the comparison of Condition I over Condition III differences ($P < .05$), (b) the females improved more than the males did in the comparison of Condition II over Condition III; this difference was not significant, (c) the males improved more than the females did in the comparison of Condition I over Condition II; this difference was not significant.

Sound X Sex X Pre-Post-Test. Table I indicates that this interaction was significant. Table III shows that the directions of differences between sounds differed from male to female. The ranking per sound from greatest to least for males was: [θ, ð, ɪ, ʊ, ɛ] , the ranking per sound from greatest to least for females was: [θ, ð, ɪ, ɛ, ʊ]. The only significant difference for single sounds between males and females on the pre-post-test was for [ð] ($P < .05$).

Note in Table II that when we consider the sound x sex x pre-post-test interaction in Condition I over Condition III, there is a significant difference in [θ] for males and females. The males demonstrated 1.30 fewer errors than the females did ($P < .05$). This interaction is a quadruple one and Table I shows that it is significant.

Additional interactions which are of secondary interest in this report are presented in Table I for the reader who may be interested in exploring them.

PRE-FOLLOW-UP-TEST MAIN VARIABLE RESULTS

Table V and VI indicate that pre-post-test differences remained essentially unchanged four months later when the follow-up-test was administered. Whatever significant differences existed at the time of the post-test still existed four months later at the time of the follow-up-test with three exceptions. In the pre-post-test comparison of Condition I and III the average error difference of 1.13 for [ɪ] was significant ($P < .05$); in the pre-follow-up test the figure of .99 for [ɪ] was not significant (compare Table II and V). In the pre-post-test comparison of Condition II and III the average error difference of 1.20 for [ð] was significant ($P < .05$); in the pre-follow-up-test the figure of 1.04 for [ð] was not significant (compare Table II and V).

The main exception concerns a continued decrease in errors by Condition I males in their articulation of [θ] from post-test to follow-up-test. These males showed a significant decrease in errors in their articulation of [θ] by an average of 2.30 fewer errors ($P < .01$, compare Table III and VI). This continued decrease in errors for [θ] can further be noted by observing in the I over III comparison that males showed a significant decrease in errors for [θ] by an average of 2.08 fewer errors from post-test to the follow-up-test ($P < .01$, compare Table II and V). Moreover, in a comparison of Condition I and II, the males showed a significant decrease in errors for [θ] by an average of 2.51 fewer errors from the post-test to

the follow-up-test ($P < .01$, compare Table II and V). This lower error score for Condition I males over Condition II males was not present in the pre-post-test results. None of these indications of decreased errors are observed for the female. In this connection notice that the male-female error difference for $[\theta]$ between Condition I and III is a significant difference of 3.49 fewer errors ($P < .01$, see Table V), as compared to the significant male-female difference of 1.30 fewer errors in the pre-post-test results ($P < .05$, see Table II). A significant male-female error pre-follow-up test difference now emerges in a comparison of Condition I and II for $[\theta]$ of 2.79 fewer errors in favor of the males ($P < .01$, see Table V). There were no significant male-female differences between Condition I and II for the pre-post-test results.

DISCUSSION OF THE PRE-POST-TEST MAIN VARIABLE RESULTS

The discussion of the pre-post-test findings will center around the questions which were asked in the purpose section of the report. The questions have been re-stated below for convenience.

Condition I versus Condition III.

> Would a larger, more representative sample of pupils (than in the pilot study) taking an experimental course covering vowels as well as consonants, show significantly better articulation than a control group receiving speech improvement in the normal elementary language arts program at the end of the study?

The results described under the pre-post-test interaction section (see Table II) show a positive answer to this question, and present several interesting pieces of information.

The average pre-post-test improvement score of 1.36 fewer errors was significantly greater for Condition I than for Condition III ($P < .01$, see Table II). A more evaluative picture of this figure's meaning may be obtained by comparing 1.36 to the average pre-test error figure of 4.06 for all subjects and conditions (see Table IV). This comparison demonstrates a significant improvement of 33% fewer errors between Condition I and III for all sounds and subjects.

The same type of comparison may be made with [θ, ð, ɪ] which all showed significant Condition I over III pre-post-test increased

differences (compare Table II and IV). The significant figure of 2.82 fewer errors ($P < .01$) is an improvement score for [θ] which is 40% of the original pre-test error score of 6.93 for [θ] over all subjects and conditions; the significant figure of 1.51 fewer errors ($P < .02$) is an improvement score for [ð] which is 42% of the original pre-test error score of 3.53 for [ð] over all subjects and conditions; the significant figure of 1.13 fewer errors ($P < .05$) is an improvement score for [ɪ] which is 33% of the original pre-test error score of 3.34 for [ɪ].

These figures of 40% improvement, 42% improvement, and 33% improvement all represent significant percentage improvement scores. The fact that they were obtained in the relatively brief amount of time allotted to each sound during the teaching phase of the experiment (three weeks of formal study for each sound and varying amounts of review time), makes the results even more impressive. However, it should be noted that although the improvement scores were substantial ones, in all probability the relatively brief amount of time available for improving each sound was a limiting factor in additional pupil progress. The investigator anticipates that a longer retraining period, e.g., an entire school year, would probably demonstrate still larger error reductions.

It may be of further interest to note in Table II in a comparison of Condition I and III that male improvement was more highly significant

than female improvement, 1.61 fewer errors ($P < .005$) versus 1.10 fewer errors ($P < .05$), and that the males improved significantly on [θ] whereas the females did not, 3.47 fewer errors ($P < .01$) versus 2.17 fewer errors. It can be seen that the significant increase in improvement in overall data for [θ] was largely due to the performance of the males. In this experiment, males appeared to have derived more help from the combination of classroom and television instruction than the females did. There were no apparent reasons for this.

Condition II versus Condition III.

Would the experimental, group non-television speech improvement course show significantly better articulation than a control group receiving speech improvement in the normal elementary language arts program at the end of the study?

The results described under the pre-post-test interaction section (see Table II) show a positive answer to this question, and present several interesting pieces of information.

The average pre-post-test improvement score of .94 fewer errors was significantly greater for Condition II than for Condition III ($P < .02$, see Table II.) A more evaluative picture of this figure's meaning may be obtained by comparing .94 to the average pre-test error figure of 4.06 for all subjects and conditions (see Table IV). This comparison

demonstrates a significant improvement of 23% fewer errors between Condition I and III for all sounds and subjects.

The same type of comparison may be made with [θ, ð] which showed significant II over III pre-post-test increased differences (compare Table II and IV). The significant figure of 1.96 fewer errors ($P < .01$) is an improvement score for [θ] which is 28% of the original pre-test error score of 6.93 for [θ] over all subjects and conditions; the significant figure of 1.20 fewer errors ($P < .05$) is an improvement score for [ð] which is 34% of the original pre-test error score of 3.53 for [ð] over all subjects and conditions.

The comments made previously on p. 33 regarding the time factor in the comparison of Condition I over Condition III are relevant here. The figures of 28% improvement and 34% improvement represent significant percentage improvement scores and are particularly impressive in view of the amount of time given to the teaching phase of the experiment. Once again, a longer retraining period would probably demonstrate still larger reductions in the number of errors.

Condition I versus Condition II.

Would there be any significant difference in articulation improvement between the two experimental groups?

The results described under the pre-post-test condition interaction section (see Table II) show that there was no significant difference in articulation improvement between Condition I and Condition II. These results lead to the following conclusions.

1. A speech improvement program utilizing the type of television and classroom instruction carried out in this study is as effective as a similar program relying only on classroom instruction.

2. Television instruction is probably not a significant factor in supplementing a group speech improvement course when the telecasts are limited to a series of 30, fifteen-minute bi-weekly programs. It is possible that an increase in the number of weekly telecasts might have resulted in a significant difference between Condition I and II.

3. Materials that are pertinent to the subject's problems and teacher awareness of proper speech correction techniques are probably more important factors than television presentations in a speech improvement program.

Condition III.

It is necessary to say a few words at this point about the Control group. The chart on p. 15 indicates that most of the Condition III children were exposed to the experimental sounds for longer periods of time than the Condition I or II children, although it is not possible to state exactly how much time was spent on speech improvement and specifically what kind of instruction these children received. Note that six teachers stated that they taught speech improvement systematically, and twelve teachers indicated that they taught speech improvement incidentally. However, the investigator discussed these incidental

programs with some of the twelve teachers involved, and their comments indicated that the programs were well-planned and organized. The investigator would not necessarily consider these programs as examples of incidental teaching. In view of the evident superiority of Condition I and II over Condition III, it would appear that the current Oahu elementary language arts program in speech improvement - as suggested by the present language arts guide and applied by Oahu's elementary school teachers - is not meeting the needs of Hawaii's children with maximum efficiency. It is probable that the speech improvement programs elsewhere in Hawaii are equally deficient. It appears to the investigator that a revision of the current elementary language arts curriculum in speech improvement would be desirable. Perhaps a program similar to one of the experimental programs described in this report might meet the dialectal articulatory problems of Hawaii's children more effectively. Regardless of the type of curriculum change considered, the investigator believes it is imperative for any altered speech improvement program to include the following: (a) provision for systematically planned daily lessons, (b) provision for pertinent materials, (c) provision for correct speech correction techniques.

DISCUSSION OF THE PRE-FOLLOW-UP-TEST MAIN VARIABLE RESULTS

The discussion of the follow-up-test findings will center around the question posed in the purpose section of the report.

> How much significant change would remain in the articulation of all experimental and control children when they were retested four months after the study was completed?

The results described in the pre-follow-up section indicate that most of the significant pre-post-test differences still existed four months later. Condition I and Condition II subjects continued to maintain their superiority over Condition III, apparently Condition I and II students were still benefiting from the experimental programs despite a time lapse of four months that included summer vacation.

The average pre-follow-up-test score of 1.56 fewer errors was significantly greater for Condition I than for Condition III ($P < .005$, see Table V), and a comparison of 1.56 to the average pre-test error figure of 4.06 for all subjects and conditions demonstrates a significant improvement of 38% fewer errors in the Condition I and III comparison for all sounds and subjects. This compares favorably with the figure of 33% fewer errors achieved at the end of the post-test. The average pre-follow-up-test score of .81 fewer errors was significantly greater for Condition II than for Condition III ($P < .05$, see Table V), and a comparison of .81 to the average pre-test error figure of 4.06 demonstrates a significant improvement of 20% fewer errors between Condition II and

III for all sounds and subjects. This compares favorably with the figure of 23% fewer errors achieved at the end of the post-test.

The most interesting finding in the follow-up-test was the continued significant decrease in errors on the articulation of [θ] by Condition I males. The trend established by the superiority of Condition I over Condition III for [θ] in the pre-post-test was more pronounced in the follow-up-test, because of the continued significant reduction in errors by the Condition I males. The pre-post-test results indicated that the significant improvement in overall data for [θ] was largely due to the male's performance. The follow-up-test results demonstrated that the continued improvement for [θ] was due exclusively to male performance, since there was no significant change in the female score from the pre-post-test to the follow-up-test. In addition, there was a significant reduction in errors for [θ] between Condition I males and Condition II males. This superiority of Condition I males over Condition II males was not present in the pre-post-test results.

In the pre-follow-up-test comparison of [θ] for Condition I and III, the significant figure of 3.81 fewer errors ($P < .005$) is an improvement score for [θ] which is 55% of the original pre-test error score for [θ] of 6.93 over all subjects and conditions (see Table IV and V). This compares with a figure of 40% from pre-to-post-test. When the Condition I males are considered alone in the comparison of Condition I and III for [θ], the significant improvement score of 5.55

fewer errors ($P < .005$) is 73% of the original pre-test error score for males over all conditions (see Table IV and V). The progress of the Condition I males for [θ] must be considered excellent. Their progress is even more remarkable when it is noted again that significantly more errors were made on [θ] than the average number of errors made on all sounds, and that on the pre-test the males were significantly worse than the females by 1.14 greater errors over all sounds and all conditions, ($P < .01$, see Table IV).

It appears that the additional auditory and visual stimuli of television enabled the males to continue improving their articulation of [θ]. Although television instruction was probably not a significant factor in the pre-post-test results in terms of the time available for the experiment and the amount of instruction presented on television, it seems that television's impact can be vivid enough to provide continued follow-up learning for males on a particularly difficult sound. There is no apparent reason why television did not provide continued improved articulation of [θ] for females.

The pre-follow-up percent improvement score for [θ] in the comparison of Condition I over III has been discussed (see above). It is of further interest to examine the pre-follow-up percent improvement figures for the remaining sounds still showing significant increased differences, and then to compare these figures with the comparable percentage improvement scores found at the end of the pre-post-test period.

In the pre-follow-up-test comparison of [ð] for Condition I over III, the figure of 1.59 fewer errors ($P < .05$) is an improvement score for [ð] which is 45% of the original pre-test error score for [ð] of 3.53 over all subjects and conditions. This figure compares favorably with the pre-post-test figure of 42% for [ð] .

In the pre-follow-up test comparison of [θ] for Condition II over Condition III, the figure of 1.60 fewer errors ($P < .05$) is an improvement score for [θ] which is 23% of the original pre-test error score of 6.93 over all subjects and conditions. This figure compares favorably with the pre-post-test figure of 28% for [θ].

Thus after a four month time lapse that extended through the summer vacation, the children in Condition I and Condition II still retained most of the significant percent improvement scores established in the pre-post-test comparison, and the males in Condition I had significantly extended their gains for [θ]. Considering the brief amount of retraining time available for each of these sounds and the four-month time lapse between tests, the ability of the experimental population to retain most of their substantial progress is an impressive argument in favor of the efficiency of the experimental methods versus the inefficiency of the control methods.

SUMMARY OF THE PRE-POST-TEST AND THE PRE-FOLLOW-UP-TEST MAIN VARIABLE RESULTS

Pre-Post-Test

1. Television versus Control. These results demonstrated that the students in the group television-classroom instructional program had significantly superior articulation at the end of 16 weeks of experimental instruction in speech improvement in comparison to the articulation of control students who were following the Department of Public Instruction's normal elementary language arts program in speech improvement. The television group demonstrated a significant improvement of 33% fewer errors for all sounds and subjects. Individual significant sound differences for all television subjects included: 40% improvement for [θ] , 42% improvement for [ð] , and 33% improvement for [ɪ] . No significant differences were found for final two sounds studied, [ɛ] and [ʊ] .

2. Non-Television versus Control. These results demonstrated that the students in the group non-television-classroom instructional program had significantly superior articulation at the end of 16 weeks of experimental instruction in speech improvement in comparison to the articulation of control students who were following the Department of Public Instruction's normal elementary language arts program in speech improvement. The non-television group demonstrated a significant improvement of 23% fewer errors for all sounds and subjects. Individual

significant sound differences for all non-television subjects included: 28% for [θ] and 34% for [ð] . No significant differences were found for [ɪ] , [ɛ] , and [ʊ] .

3. Television versus Non-Television. There were no significant differences in articulation improvement between these two groups.

Pre-Follow-Up-Test

1. Television versus Control. The superiority of the group television-classroom instructional program over the control group was still apparent four months after the study was completed. The television group demonstrated a significant improvement of 38% fewer errors over all sounds and subjects. Continued significant improvement was found in [θ] for males, but not for females. Individual significant sound differences for all television subjects included: 55% for [θ], 45% for [ð] . No significant differences were found for [ɪ], [ɛ] and [ʊ] .

2. Non-Television versus Control. The superiority of the group non-television classroom instructional program over the control group was still apparent four months after the study was completed. The non-television group demonstrated a significant improvement of 20% fewer errors over all sounds and subjects. Individual significant sound differences for all non-television subjects included: 23% for [θ] . No significant differences were found for [ð], [ɪ] , [ɛ] and [ʊ].

3. Television versus Non-Television. There were no significant differences in articulation improvement between these two groups.

Commentary

1. A speech improvement program utilizing the type of television and classroom instruction carried out in this study is as effective as a similar program relying only on classroom instruction. Materials that are pertinent to the subject's problems and teacher awareness of proper speech correction techniques are probably more important factors than television presentations in a speech improvement program.

2. It would appear that the present elementary language arts program in speech improvement sponsored by the Department of Public Instruction is inefficient, and that a modification in this current program would more closely meet the needs of Hawaii's children who have dialectal articulatory problems. It is essential that any curriculum modification include the following: (a) systematically prepared daily lesson plans, (b) materials that are pertinent to the articulation needs of Hawaii's children, (c) awareness of proper speech correction techniques on the part of elementary teachers. The suggested curriculum change appears justified in view of the pre-post-test and pre-follow-up-test results.

PRE-POST-TEST ADDITIONAL VARIABLE RESULTS

In addition to the main variables which have been fully discussed in the preceding sections, the following variables were investigated for possible correlations with pre-post-test changes: (a) race, (b) parental occupation, (c) personality characteristics, (d) group size. These variables were discussed earlier in the procedural sections.

(a) Would racial ancestry significantly affect the degree of improved articulation in the experimental and control groups? Particular interest was focused on children of Japanese, Chinese, Hawaiian and part-Hawaiian, and mixed background (see p. 3).

The desired racial information was available on 401 children who took the post-articulation test, and they were regrouped in the following manner: Condition I, Japanese - 53, Chinese - 7, Hawaiian and part-Hawaiian - 22, mixed - 50; Condition II, Japanese - 62, Chinese - 10, Hawaiian and part-Hawaiian - 19, mixed - 33; Condition III, Japanese - 80, Chinese - 13, Hawaiian and part-Hawaiian - 19, mixed - 33. Use was made of chi-square to test for significance among the various racial groups, but no significant differences were found.

(b) Would parental occupational backgrounds significantly affect the degree of improved articulation in the experimental and control groups?

The parents of the 522 children who received the post-articulation test were categorized according to occupations following the Classified Index of Occupations and Industries (see p. 16). Use was made of chi-square to test for significance among the various occupational groups, but no significant systematic differences were found.

(c) What differences in personality characteristics, e.g., the degree of interest and motivation in speech improvement, would result from student participation in the two experimental programs? Would there be any significant difference in these personality characteristics between either experimental group and the control group?

The 522 children who received the post-articulation test were evaluated for personality characteristics according to a test devised by Sarason and Davidson (see pp. 16 and 17). Use was made of chi-square tests and correlations between traits and difference scores, but no significant systematic differences were found.

(d) Would the size of the individual speech groups influence the efficiency of speech improvement?

The 348 subjects who were placed in the original six groups of 58 subjects after the post-test were regrouped in the following manner: (a) class groups that contained from 5 to 9 children, (b) class groups that contained from 10 to 14 children, (c) class groups that contained from 15 to 20 children. Use was made of chi-square to test for

significance among the three groups, but no significant systematic differences were found.

TABLE I

Source of Variation*	Degrees of Freedom	Sums of Squares	Mean Squares	F Ratio	Significant Level
1	2	390960.25000	195480.12500	4490.46271	.001
2	4	551846.25000	137961.56250	3169.17769	.001
3	2	5122.75000	2561.37500	58.83851	.001
4	1	9074.75000	9074.75000	208.46020	.001
5	55	25442.75000	462.59545	10.62649	
12	8	1412644.43750	176580.55469	4056.31210	.001
13	4	3175.92578	793.98145	18.23891	.001
14	2	2173.79639	1086.89819	24.96763	.001
15	110	12427.52197	112.97747	2.59526	
23	8	10592.05420	1324.00677	30.41436	.001
24	4	5552.65527	1388.16382	31.88814	.001
25	220	8566.66211	38.93937	0.89449	
34	2	1949.12646	974.56323	22.38713	.001
35	110	3272.07373	29.74612	0.68331	
45	55	8747.59521	159.04718	3.65354	
123	16	32963.25000	2060.20312	47.32586	.001
124	8	19014.75000	2376.84375	54.59946	.001
125	440	52496.75000	119.31079	2.74074	
134	4	5197.25000	1299.31250	29.84709	.001
135	220	8444.75000	38.38523	0.88176	
145	110	47246.75000	429.51591	9.86660	
234	8	15405.75000	1925.71875	44.23656	.001
235	440	19749.75000	44.88580	1.03109	
245	220	21419.25000	97.36023	2.23651	
345	110	8050.75000	73.18864	1.68125	
1234	16	31648.63184	1978.03949	45.43844	.001
1235	880	33577.44824	38.15619	0.87650	
1245	440	27002.71338	61.36980	1.40975	
1345	220	4060.50684	22.54776	0.51795	
2345	440	12599.05908	28.63423	0.65777	
RESIDUAL	875	38090.75000	43.53229		

* 1 - Condition variable
2 - Sound variable
3 - Test variable
4 - Sex variable
5 - Differences between subjects variable

TABLE II

CONDITION DIFFERENCES IN PRE-POST-TEST SCORES
(PRE MINUS POST ERRORS)

	Condition I Minus III			Condition II Minus III			Condition I Minus II		
	Sex			Sex			Sex		
Sound	M	F	Av.	M	F	Av.	M	F	Av.
[θ]	3.47	2.17	2.82	2.38	1.53	1.96	1.09	.64	.87
[ð]	2.01	1.02	1.51	1.01	1.40	1.20	1.00	-.38	.31
[ɪ]	.95	1.31	1.13	.31	.85	.58	.65	.46	.56
[ɛ]	.50	.36	.43	.07	.40	.24	.43	-.04	.20
[ʊ]	1.14	.66	.90	.67	.78	.73	.47	-.12	.18
Average	1.61	1.10		.89	.99		.73	.11	
Total Average			1.36			.94			.42

TABLE III

PRE-POST-TEST DIFFERENCES
(PRE MINUS POST ERRORS)

	Condition I		Condition II		Condition III		Average		Total Average
	Sex		Sex		Sex		Sex		Sex
Sound	M	F	M	F	M	F	M	F	M - F
[θ]	4.91	4.10	3.82	3.46	1.44	1.93	3.39	3.16	3.28
[ð]	3.18	1.39	2.18	1.77	1.17	.37	2.14	1.18	1.66
[ɪ]	1.65	1.37	1.01	.91	.70	.06	1.12	.78	.95
[ɛ]	.86	.68	.43	.72	.36	.32	.55	.57	.56
[ʊ]	1.41	.58	.94	.70	.27	-.08	.87	.40	.64
Average	2.40	1.62	1.67	1.51	.79	.52	1.62	1.22	
Total Average	2.01		1.59		.65				1.42

TABLE IV

PRE-TEST ERROR SCORES
INDICATING THE SEVERITY OF THE ORIGINAL PROBLEM
(12 ITEMS PER TEST)

	Condition I Sex		Condition II Sex		Condition III Sex		M & F Av.		Total Average
Sound	M	F	M	F	M	F	M	F	
[θ]	8.4	6.3	7.1	6.4	7.1	6.3	7.53	6.33	6.93
[ð]	4.8	2.3	4.2	3.1	4.3	2.5	4.44	2.63	3.53
[ɪ]	3.7	2.7	4.2	3.7	3.7	2.5	3.86	2.83	3.34
[ɛ]	3.8	3.1	4.5	4.4	3.3	3.3	3.86	3.60	3.73
[ʊ]	3.5	2.0	3.8	2.6	3.1	1.7	3.46	2.10	2.78
Average	4.86	3.27	4.79	4.03	4.33	3.28	4.63	3.49	4.06

TABLE V

CONDITION DIFFERENCES IN THE PRE-FOLLOW-UP TEST SCORES
(PRE MINUS FOLLOW-UP ERRORS)

	Condition I minus III Sex			Condition II minus III Sex			Condition I minus II Sex		
Sound	M	F	Av.	M	F	Av.	M	F	Av.
[θ]	5.55	2.06	3.81	1.95	1.25	1.60	3.60	.81	2.21
[ð]	2.04	1.13	1.59	.76	1.31	1.04	1.28	-.18	.55
[ɪ]	.77	1.21	.99	.24	.98	.61	.53	.23	.38
[ɛ]	1.04	.89	.97	.36	.92	.64	.68	-.03	.33
[ʊ]	.75	.13	.44	-.02	.36	.17	.77	.41	.59
Average	2.03	1.09		.66	.96		1.37	.25	
Total Average			1.56			.81			.81

TABLE VI

PRE-FOLLOW-UP TEST DIFFERENCES
(PRE MINUS FOLLOW-UP ERRORS)

	Condition I		Condition II		Condition III		Average		Total Average
	Sex		Sex		Sex		Sex		Sex
Sound	M	F	M	F	M	F	M	F	M-F
[θ]	7.21	4.20	3.61	3.39	1.66	2.14	4.16	3.24	3.70
[ð]	3.14	1.09	1.86	1.27	1.10	-.04	2.03	.74	1.39
[ɪ]	2.07	1.82	1.54	1.59	1.30	.61	1.84	1.34	1.59
[ɛ]	1.86	1.43	1.18	1.46	.82	.54	1.29	1.14	1.22
[ʊ]	1.34	.45	.57	.04	.59	-.32	.83	.06	.45
Average	3.12	1.80	1.75	1.55	1.09	.59	2.03	1.31	
Total Average	2.46		1.65		.84				1.67

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